

New Forms of Democracy

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Abstract

In the third decade of the 21st century, digitization, global events, challenges from authoritarian states, and difficulties of particular democracies to function properly confront democracy with a new series of challenges and opportunities that will force it to reinvent itself. The last decades have produced an accelerating flow of ideas for new forms of democracy. We survey a long period in the quest for such new forms and point to next inventions for such forms. We suggest to experiment with new ways for democracy to extend the choice of democratic processes that can be implemented in real-life situations, with the beneficial side-effect that democracy might remain the only sustainable structure for self-governing societies.

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1 Introduction

The chaotic transition between US presidents Donald Trump and Joe Biden, culminating in the Capitol riots of January 6, 2021, demonstrated how fragile democratic institutions can become and how urgently we need to strengthen them for the hazardous times ahead. In a divided society, merely winning an election by no means guarantees legitimacy, let alone authority. Accordingly, our goal is to assess the potential and the limitations of a number of unprecedented ideas designed to renew and strengthen democratic decision-making, with a view to re-establish democratic sustainability and, wherever feasible, using digitization for that purpose.

Regarding the latter, at work, in politics, and in society at large, there has been a giant leap toward full digitization. Of course, the full impact of ongoing digitization remains to be assessed, and some of its consequences will only become evident in the more distant future. But whatever it brings, digitization is very much a one-way street.

Now that we have gained extensive experience with it in all spheres of life, we have the unique opportunity to adapt digitization to our needs. This is the perspective from which we shall be looking back on twenty years of democracy research to examine the potentialities and limitations of the new tools we have developed for democracy, under the assumption that all the amenities of digitization are now fully available.

In a democracy, the key features of the election process, secrecy and equal voting rights on the one hand, comprehensive, and accurate and equitable vote-counting on the other, must be guaranteed to ensure that the collective decisions thus produced will reflect the true preferences of the electorate. But once these features are provided on a secure digital basis, democracies suddenly have at their disposal a toolkit that allows for large-scale experimentation in voting procedures, with the goal of developing optimal decision procedures and obtaining results that can enhance the welfare of societies.

Before we start, a word of caution is in order. Every new procedure proposed here has to pass the test of in-depth scrutiny, and drawbacks or unexpected collateral effects may show up in the process. Only future research can tell whether the voting schemes we analyze here are indeed viable in real-world contexts.

Drawing upon several decades of democracy research, we identify four fields of innovation in which digitization can be a useful tool and which can make democracy resilient in a digitized world. We present each of them in turn, focusing on the most important ideas addressed in these fields.

The approach pursued in this article is motivated by the great potential to invent new forms of democracy.¹ It is also motivated by entire fields of thinking. First, social choice

¹See also Gersbach (2005) and Gersbach (2017c) for a comprehensive view of our research field up to 2017. These books also contain other proposals for reforming democracy via Political Contracts (comprehensively surveyed in Gersbach (2012)) and also applied in various proposals for new voting and election rules, e. g. when candidates for office can offer a reelection hurdle they will be subject to

theory is the theoretical bedrock of all of our investigations. With its possibility and impossibility theorems, it has indicated the potential inherent to various attempts to arrive at sound collective decisions and the challenges those attempts are prone to. Alongside the famous possibility and impossibility theorems, this theory has also produced a large variety of voting and election rules (Laslier and Sanver (2010), Patty and Penn (2014), and Felsenthal and Nurmi (2018) for excellent comprehensive accounts). It still continues to produce new forms of such rules (see e.g. Bouton et al. (2018), Nehring and Puppe (2019), Pivato and Soh (2020), and Bartholdi et al. (2021)).

Second, given the fact that politicians may have differing motives when they compete for office, political economy considerations play a role in many of our suggestions. Third, the constitutional perspective adopted by Buchanan and Tullock (1962) suggests that it is wise to consider new forms of democracy from a social-contract perspective in which rules for collective decisions and rules for the three powers—legislative, executive, judiciary—are necessarily evaluated and decided upon in the restrictive circumstances imposed by a veil of ignorance, i.e., from an *ex ante* perspective in which individuals do not know what situation they will be in when the rules are applied. Fourth, from a liberal perspective, as advocated by Hayek (1960), identifying the constraints democracy places on individual behavior and engaging in the search for better forms of democracy is the task of any liberal-minded researcher. Moreover, good rules may beget civic virtues.²

An important remark is in order. All of our new forms of democracy rely on the principle one-person-one-vote, at least from an *ex-ante* perspective, and they do not allow for selling and buying votes for money or other benefits.³ While the basic idea of vote trading has a long tradition (see Coleman (1966)), a large literature has explored various ways how such markets can be organized and which results can be expected—for competitive markets, strategic market games, decentralized bargaining, and quadratic vote-buying mechanisms, for instance. In particular, the latter approach has attracted a large interest as an alternative way to organize democracy. It rests on the assumption that an agent can acquire an amount of voters at a quadratic cost function.

While quadratic voting mechanisms maximize utilitarian welfare in various settings if preferences are quasi-linear in money and the electorate is large (see Goeree and Zhang (2017), Lalley and Weyl (2019), Eguia et al. (2019) and Eguia and Xefteris (2020)), incentives to collude, difficulties to calibrate the costs-function wealth effects and the fundamental concerns regarding deviations from one-person-one-vote call for caution regarding real-world applications (see Kaplow and Kominers (2017), Laurence and Sher

(see e.g. Gersbach (2020a)). Hence, these approaches (new voting and election procedures) and Political Contracts overlap when, say, candidates can offer a reelection scheme in a Political Contract.

²See Vanberg (2014) for an assessment of Hayek’s work, Kolev (2020) for its connections with our research, and Dold and Lewis (2022) on Hayek’s views on endogenous preferences and how social structures, including formal and informal rules, may shape preferences.

³A comprehensive overview of all forms of vote trading can be found in Casella and Macé (2021).

(2017) and Weyl (2017) for discussions). We do not detail these approaches in this paper and refer to Casella and Macé (2021) for an in-depth discussion.

Also in other branches, researchers search for new forms of democracy. For instance, deliberative democracy (Elster (1998)) has opened up new way how collective decision-making may be organized (see Blondiaux and Manin (2021) and Goodin (2008)). Bourg et al. (2017) explore how well-designed citizen chambers may help to take into account the well-being of future generations in order to tackle long-term challenges such as climate change. An alternative suggestion how to solve this problem was developed by Gersbach and Kleinschmidt (2009).

2 Voting and Proposal-making with Signals and Representation

2.1 Signals by Assessment Groups

The first field we turn to is concerned with what we call "the voters' will". What does the electorate want? How can this be assessed? How can this be reflected in all stages of the decision-making process?

We start with the ur-setting, i.e. direct democracy. Every citizen has a right to vote, and all votes count equally. We outline a promising way of using assessment groups to generate signals either for other voters or for making new proposals.

2.1.1 Assessment Voting (AV)

Problem. How can the will of citizens—in the simplest case the preferences of the majority in binary collective decisions—be determined when voluntary one-round voting may yield an inefficient level of turnout and the majority may not win? Compulsory voting reflects the will of the majority but requires that all citizens incur the cost of voting.

Idea. Assessment Voting is a two-round voting procedure that promises to be an improvement over both single-round voluntary voting and compulsory voting. It works as follows: instead of the entire citizenry voting at the same time, the following two-round procedure comes into play:⁴

1. A number of citizens are randomly selected from the entire population. These citizens constitute the "Assessment Group" (AG).
2. All members of AG cast a (simultaneous) vote for one of the eligible alternatives or abstain.

⁴See Gersbach (2015) and Gersbach et al. (2021b). The procedure we suggest may also be adapted for the use in representative democracy, which we address in Section 5.1.

3. The number of votes in favor of either alternative obtained in the first round is made public.
4. All citizens who do not belong to AG (simultaneously) decide whether to abstain or to vote for one of the alternatives. Thus the second voting round takes place.
5. The alternative with the most votes in the two rounds combined is elected. Ties are decided by a fair toss of the coin.

Approach. To assess the properties of AV, we consider in Gersbach et al. (2021b) a model of a society that needs to choose between one of two alternatives, say A and B. Each citizen’s preference is private information and is independently drawn from a given common distribution. Without loss of generality, suppose that ex ante, it is more likely that a citizen will prefer A to B than B to A, and that intensity of preferences for the preferred alternative is the same for all citizens. This means that A is the desirable alternative from an ex-ante utilitarian perspective. For each citizen, there is also a cost $c > 0$ involved in going to the ballot box. While such participation costs are private, they may also be legitimately considered in the societal calculus. From a utilitarian perspective, the right decisions have to be made at the lowest possible average cost of participating in the voting procedure, given standard democratic constraints such as the right of every citizen to vote.

Results and discussion. In many cases, the features set out above yield a multiplicity of equilibria. Nevertheless, we can prove that if voting is compulsory in the first round—or incentivized through subsidies—and the size of the first group is not too small, only one equilibrium of the subgame beginning after the publication of the first-round vote count will survive, i.e. no citizen will cast a vote in the second round. This implies that the outcome (i.e., the alternative chosen and the costs of voting incurred by all citizens) is fully determined in the first round. While this is admittedly a very strong prediction, it is reasonable to expect that the main mechanisms underlying this prediction will also operate in real-world environments.

If the composition of this group is sufficiently representative of the entire citizenry, socially optimal alternatives will be chosen at low societal cost and without the need to deprive citizens of their right to vote. The low level of turnout in the second round is simply the result of a cost-benefit analysis made by the citizens participating in this voting round, all of whom will be aware of the result in the first round.

Our work on Assessment Voting enables us to show that compared to standard one-round voting processes, better outcomes can be achieved and voting costs can be significantly reduced by taking advantage of all digital tools available for the AG selection process and for the two-round voting process itself.

The use of a random sample of the population who is given voting rights entails the issue of representativity. If we replace the one-citizen-one-vote system by a procedure in

which only a subset of the citizens is given voting rights, it is key for the acceptance of the final decision that *all* citizens feel well represented by this voting subset.⁵ This will be taken up in Subsection 2.2.1, where new representation systems are discussed.

Using randomly sampled groups in democracy is an old idea—and was used in Venice and ancient Greece.⁶ Random draws were used to select committee members to elect the executive. Our case is different, although the members of the AG do not have more voting power formally than other citizens, since the one-person-one-vote principle still applies. Yet, the AG votes earlier and the results of its voting round are published—this makes the difference.

2.1.2 Assessment Voting, information efficiency and voting norms

While Assessment Voting has been introduced to enable the majority in the electorate to implement its preferred alternative and to economize on voting costs, it might also be quite useful to improve the information efficiency of collective decisions. Suppose the citizens are unsure about the (utility) consequences of alternatives they are voting on. An informationally efficient collective decision means that the outcome is the same as when all individuals are completely informed about the consequences of all alternatives upon which they are voting (see e.g. Gersbach (1995) and (2000)).

Since members of the AG anticipate that the collective decision in the first stage is likely to be in line with the final result, they have higher incentives to acquire information than when the whole electorate votes at once. It may even be possible to establish a social norm that members of the AG are expected to be thorough in assessing and comparing the consequences of different alternatives, as the rest of the electorate may rely on their vote either by abstaining or confirming the outcome achieved in the first round. This may be further supported by ways to make information acquisition and voting cheap or cost-free for members of the AG. For instance, the members of the AG may be allowed to take a half day or full day off from work without pay cut to acquire information and to vote. The potential and limits of the ideas presented in this subsection have not been established in suitable models and await thorough investigation.

2.1.3 Pendular Voting

Moreover, many variants of Assessment Voting deserve consideration. For instance, in response to Assessment Voting, initiatives may be discontinued or revised after the first voting round. Even counterproposals can be made, triggering a restart of the two-round voting process. Assessment Voting can also help solve quite basic problems in democracies, which is addressed next.

⁵For an assessment of the concept of representation, see Pitkin (1967). For an analysis of its principles and genealogy, see Urbinati (2006).

⁶See <https://www.wikiwand.com/en/Sortition>, accessed August 10, 2022.

Problem. How can the revelation of information be integrated in democratic procedures? This is one of the fundamental issues preoccupying democracy research. More specifically, how can revelation of information on preferences be achieved before proposals are put to the vote, or, more precisely, how can proposals be adjusted in the light of new information before final, irreversible collective decisions are taken? What this boils down to is examining how voting processes can be organized when individual preferences are private information but the distribution of these preferences is common knowledge.

Idea. Several ways are conceivable. For instance, "Pendular Voting" (PV), introduced in Britz and Gersbach (2021), is an idea for a democratic modus operandi that is based on a simple two-stage voting process in which a variant of Assessment Voting is used.

In the first stage, only a random sample of the population votes on the proposal, as in Assessment Voting. The result of the first stage is made public, thus conceivably revealing information about the underlying distribution of preferences in the electorate. Depending on the outcome of the first stage, a third alternative alongside the proposal and the status quo comes into play. This alternative is closer to or further away from the status quo, depending on the result of the first stage. Who determines the third alternative is detailed at the end of this subsection, in the paragraph about implementation. Finally, the entire electorate expresses pairwise preferences with regard to the status quo, the initial proposal, and the new third alternative referred to above.

Discussion. The main advantage of PV may be that an extreme proposal finding its way into the second round under PV can be expected to function as a clarion call rousing the moderate majority to adopt a more moderate proposal.

Further, PV may be in a position to provide potential remedies for some of the problems habitually affecting democracies. In direct democracy as practiced in Switzerland, for instance, digitization is a quick, comparatively easy, and inexpensive way of collecting signatures for popular initiatives. The ease with which signatures can be collected favors the emergence of unrealistic initiatives. Such initiatives could be used by parties to enhance their visibility and heighten their appeal to certain subgroups of society. This is costly for society as a whole and may even increase the likelihood of highly mobilized minorities with extreme views implementing their agendas, while a moderate, but aloof majority stands idly by. PV may be a way of addressing these issues by offering the opportunity to temper extreme proposals during the PV process.

The aftermath of the Brexit referendum is also a case in point and illustrates how Pendular Voting may improve democratic decision-making. The Brexit referendum proposed only two options ("Leave the European Union" vs. "Remain in the European Union"). It has, however, become apparent that in reality, there are many more options, such as various forms of "negotiated" Brexit, for instance a free-trade zone, a customs union, or a "no-deal" Brexit. From the perspective of fall 2022, we can safely say that

while Brexit took effect on 31 December 2020, negotiations about future relations with the EU are doomed to drag on for a long time. PV might have been a way to introduce more tractable Brexit variants and to select one of these variants early on.

Implementation. The approach leaves open who determines the third alternative. In practice, for instance in Switzerland, the parliament has the right—but not the obligation—to craft the third alternative when an initiative to change the constitution is proposed.⁷

However, there are other possibilities, since the third alternative should be determined as a result of the first voting stage and not by a new agenda-setter. Ideally, and taking the model literally, the third alternative is determined algorithmically once the outcome in the first stage is known. Yet, in practice, proposals are typically more complex than simply specifying a particular public good level, since e.g. the description of a particular public good is multidimensional. Hence, one may resort to expert commissions drafting such third alternatives, so-called "third alternative commissions", or, adopting the language of the Swiss system, "counterproposal commissions". The members of such commissions could be appointed by parliament and would be given a mandate to draft third proposals in the spirit of Pendular Voting and shielded—like central banks—as much as possible from political influence regarding the fulfilling of this mandate. One may also consider electing these members through an electorate.

2.2 Towards better representation

2.2.1 New Representation Systems and Delegation

Representative democratic institutions have often been criticized with the argument that their representatives did not map the citizenry they should represent. Several innovative proposals for entirely new representation systems have been made to improve this issue. In particular, Alger (2006), Green-Armytage (2015) and Cohensius et al.(2017) suggested representation based on proxy voting. Liquid democracy was addressed by Paulin (2014), Blum and Zuber (2016), Christoff and Grossi (2017a), Christoff and Grossi (2017b), Brill and Talmon (2018), and Kahng et al. (2018). In these systems, the weight of each legislator is directly proportional to the number of voters they represent—an idea which can be traced back to early proposals by Sterne (1871, p. 62), Tullock (1967, Ch.10 and 1992), Miller (1969), and Chamberlin and Courant (1983), and recent proposals by Laslier (2017) as well as Abramowitz and Mattei (2019). Gersbach et al. (2022a) analyze vote delegation when preferences of delegates are unknown.

The literature has established a series of important insights into the pros and cons of such new representation systems. A further proposal by Pivato and Soh (2020) assumes that the weight of a legislator is determined not only by the number of voters s/he

⁷See [https://de.wikipedia.org/wiki/Gegenentwurf_\(Schweiz\)](https://de.wikipedia.org/wiki/Gegenentwurf_(Schweiz)), accessed August 9, 2022.

represents, but also by a weighting factor that measures how *effectively* s/he represents them. The approach of Pivato and Soh (2020) is that each citizen can *choose* among all legislators who will represent him/her, and s/he specifically delegates his/her voting right to them. As a result, different legislators will receive different numbers of votes, i.e. have different voting weights, according to the number of votes delegated to them. Decisions in the legislature are then taken by weighted majority. Pivato and Soh (2020) show that for very large electorate sizes, the results of such decisions correspond to the ones this citizenry would have obtained through a popular referendum decided by majority vote.

Other approaches to new representation systems and reform ideas for direct democracy are presented in Frey (2017), for instance, who suggests several ways to renew the concept of direct participation by alternative assignment of voting rights, from an extension of direct democracy to new areas, to partial voting rights for individuals who are not citizens (non-national inhabitants of a country, for instance), different voting weights for older versus younger people, double voting rights for commuters—once in the working place and once in their living place— or decisions by lot.

There are also existing forms of democracy that appear to be functioning well and could be used more broadly. For instance, Eichenberger and Schafer (2022) indicate how the electoral system in Switzerland, which uniquely combines proportional representation and majoritarian elections on all government levels and majority votes in multi-member districts, can alleviate political failures.

2.2.2 Being represented vs feeling represented

Whether and to what extent one individual thinks s/he is represented well enough by another to waive their voting right to the representative is a complex issue. If the representative is known, things seem relatively simple at first sight: either one trusts the representative to defend one's interests or not. If a citizen does not know the representative personally, s/he will try and find more information about potential similarities. Thus, one would expect that a member of a given party thinks s/he is well represented by another member of this party. Yet, one could also argue that men might think they are insufficiently represented by women, for example, as their interests might diverge on particular issues. This leads to the second difficulty about *known* representatives: an individual might think s/he is well represented by another *on one particular issue*, but not on the other. This shows that knowing the person who represents you does not suffice for deciding whether you are well represented or not—it also depends on the contents of the decision at hand.

Instead of trying to obtain trust for an individual representative on a given issue, one could also try and obtain *trust for the representativity algorithm*. If the sample selection mechanism for the subset of citizens who will be given the right to vote is known and

generally acknowledged as fair and trustworthy, the individuals who are chosen by this algorithm do not necessarily have to be known—the citizens will trust the algorithm to yield a representative subset of the voters. This is where digitization can be extremely useful: an algorithm based on freely accessible, verifiable code, with entirely transparent selection criteria has the chance to be trusted by the citizens, even if it does not choose them individually for voting, and even if they do not know the chosen representatives' names. One could even imagine an algorithm with different selection criteria for each issue at hand, but always coupled with a transparent communication of these criteria before the sample selection takes place.

2.2.3 Random selection by fair algorithms (sortition)

Random selection of a panel such as an Assessment Group is subject to two imperatives: It must be representative of the population and all individuals should have the same probability to be chosen by the algorithm for this panel. One more desiderate is that subpopulations are also represented according to their weight in the population. Flanigan et al. (2021) describe how to develop selection algorithms that comply with these desiderata and explain how to achieve individual selection probabilities as close to equal as possible. They assess that besides improving panel selection itself, it is key to achieve the highest possible transparency as to how a selection algorithm is working. Transparency fosters trust in the fairness of algorithm selection, which ultimately guarantees that each individual will think s/he is well represented by the panel selected, no matter whether s/he is selected for it or not—and not matter the voting outcome, at least theoretically. Thus, Flanigan et al. (2021) set the practice of algorithm sortition on firm grounds: their work benefits and fosters the establishment of citizens' assemblies in a variety of decision-making processes in democracies.

3 Voting and History: From Incumbency Advantage and the Protection of Minorities to Balanced Voting and Voting Twice

3.1 The menu

Besides voters' will, we address a second area of new forms of democracy investigating two core inefficiencies of democracy: the undesirable incumbency advantage and the tyranny of the majority. Both are connected to "history". The negative effect on society emerges only after a certain time and after repeated elections or voting decisions. Let us consider incumbency advantage first. Since the approaches by Gelman and King (1990) and Alford and Brady (1989) to empirically measure incumbency advantages in congressional

elections, and Levitt and Wolfram (1997) and Cox and Katz (1996) on how to decompose these advantages into sources, a large literature on the existence and causes of incumbency advantages has emerged, which we cannot survey here. An account of the literature and unanswered questions about the incumbency advantages in the US Congress is given in Carson et al. (2020). Theoretically, for the same political platform, a society wants to elect the most able candidate for an office. Unfortunately, incumbents are often reelected easily even if their challengers are more competent. This can, of course, be detrimental for society. We try to find solutions for this problem and ideally, give all candidates equal chances of being elected according to their ability.

The second problem is the so-called "tyranny of the majority". If some citizens repeatedly find themselves in the minority and experience large utility losses, this may be undesirable from a utilitarian perspective. Moreover, this minority may be unable to affect the decisions taken in the society in question. With time, this may have a detrimental effect on both their willingness to accept such decisions and their consequences, and their willingness to vote at all. Accordingly, we attempt to find ways of cautiously protecting minorities by including them in collective decisions to a greater extent, even if they are in the minority for a given issue. As with the mitigation of incumbency advantage, where one tries to give all candidates equal chances to compete for office, our goal is to make the distribution of decision power between majority and minority more equal without abolishing the principle that alternatives that are supported by a majority are implemented. This leads to the concept of "Minority Voting" (MV), which protects individuals from repeated exploitation, since winners in a particular voting stage will have reduced voting rights subsequently, but not the losers.

We extend our reflections on the protection of minorities to the protection of those voters who may be particularly affected by a voting decision, i.e. those citizens who have strong preferences on a voting issue. This leads to a variant of Minority Voting that is called "Balanced Voting" (BV). Finally, we adhere to the basic Minority Voting concept, i.e. dividing a decision over two voting rounds, and propose a strategy named "Voting Twice", a voting procedure that may help avoid excessive public debt.

All our suggestions are most easily implemented via electronic voting, with an algorithm that adapts to any variant of vote-counting, provides statistical comparisons with earlier elections, and can implement any kind of voting procedure as well as any type of vote-weighting and voter selection. We next describe each history-based election or voting method in detail.

3.2 Dealing with the undesirable incumbency advantage problem

Dealing with incumbency advantages in democracy is a thorny and complex issue. On the one hand, some of them are undesirable, e.g. when incumbents obtain more votes simply because their name is better known to voters. Moreover, even if the incumbency advantage is desirable, e.g. because an office-holder is skilled or has become skilled in engineering the provision of public goods, it will still be preferable to prevent him/her from exploiting such advantages, e.g. by indulging in their own preferences. On the other hand, politicians gain experience by staying in office longer and may invest in socially desirable long-term projects. Hence, if they are deselected early, those projects cannot be implemented.

3.2.1 History-bound reelections

Idea. To address the negative aspects of incumbency advantages, we suggest the introduction of a new re-election rule, which we call the "Score-replication Rule". It is a manifestation of so-called "History-bound Reelections."⁸ In the simplest case, i.e. a two-candidate contest, it works as follows.

Score-replication Rule:

1. If a candidate is not the incumbent, a simple majority of votes will suffice for election.
2. If a candidate is the incumbent, s/he must win the highest percentage of votes s/he has ever obtained for this same office.
3. If the incumbent fails to achieve this highest past percentage, s/he will not be elected.

If incumbents fail to replicate—or surpass—their best past result, the situation can be dealt with in two ways. One way is to declare the challenger the automatic winner. However, this new office-holder may have received quite a small percentage of votes, which will cast doubt on their legitimacy. Alternatively, one can call a run-off between the challenger and a new candidate to ensure that the new office-holder is supported by at least 50 percent of the voters.

Clearly, a straight Score-replication Rule is strong (typically too strong), and weaker variants are desirable, as shown in Gersbach (2020a). For example, the level of votes to be attained could be lowered by a certain percentage compared to the best past score. One might also disregard the first election outcome when calculating the reelection hurdle for

⁸See Gersbach (2020a).

the incumbent. Another option is to have the incumbent attain the average percentage of all votes earned in previous elections.

Approach and Results. In Gersbach (2020a), we use a simple three-period election model to show that suitable Score-replication Rules are a modest but—as it turns out—efficient improvement of the election mechanism. Candidates from two parties compete for office, have bliss points differing from the median voter’s and their ability will be revealed in the first term if they are elected for office.

Score-replication rules offer a number of interesting properties. In particular, they achieve that office-holders indulge less in their own preferences, without deselecting particularly able office-holders. These rules can also achieve greater turnover in non-competitive districts for the US Congress and turn them into competitive ones. Finally, they can be applied to situations with more than two candidates and to democracies with proportional election systems.

Remarks. Two remarks are in order. First, History-bound Reelections via Score-replication Rules remain close enough to the majority rule and thus may be used in practice without other large changes. Second, in democracies, there may be implicit rewards for politicians who obtain high vote-shares: the higher the vote-share a candidate has obtained, the more important the parliamentary committees in which s/he may have a seat after elections. Hence, office-holders may strive for high vote-shares without history-bound elections. Yet, history-bound elections induce office-holders not to move too far away from the median-voter position if they turn out to be of sufficient ability and could achieve high vote-shares even when adopting not so moderate positions.

3.2.2 Higher hurdles for incumbents

A simpler alternative counteracting socially undesirable incumbency advantages—while preserving socially desirable incumbency benefits—is to implement higher barriers for incumbents. This means that the reelection hurdle is set higher with the number of terms in office. This increasing reelection hurdle can be provided for by a clause in an election law, for instance. Alternatively, candidates for office may be allowed to offer a reelection hurdle for themselves during campaigns. In such circumstances, the incumbent determines in advance which share of the vote will enable him/her to be reelected and use this vote-share as an argument in the election campaign. In essence, the incumbent will say, for instance, “If I do not attain 55% of the votes for reelection, I will not be allowed to accept reelection.” This is tantamount to a promise to work so well and display such high ability in office that the vote-share will reach a certain level at reelection time. Otherwise, the incumbent will not be allowed to assume office again.

This form of commitment on the part of candidates for office can be couched in “Vote-

share Contracts”.⁹ Once legally authorized and enforced, they represent a variant form of political contracts. Such Vote-share Contracts are verifiable election promises associated with remunerations and sanctions that are legally enforced.

Vote-share contracts with/without signaling of competence

Approach 1. We have examined Vote-share Contracts using two different models in two papers on the subject.¹⁰ In the first, we examine a setting in which individual candidates do not know their own ability during the election campaign and at the start of their first term. In the second, the candidates know about their ability, which enables them to set the reelection vote-threshold that is optimal for their purposes in light of their ability.

Results. Vote-share thresholds have two effects. First, a higher threshold stimulates greater effort, as the marginal gain from higher effort increases in terms of improved reelection prospects. This is socially desirable. Second, a higher vote-share threshold raises the lowest possible ability of those of the incumbents that are reelected, as only such incumbents will be able to garner enough votes. This is socially desirable as long as incumbents with above-average ability are reelected. If the threshold is too high, even incumbents with above-average qualities will be deselected, which is socially undesirable. A socially optimal vote-share threshold for incumbents will even out these effects. Typically, it will be greater than 50%.

Either a vote-share threshold can be set by the public or candidates can use Vote-share Contracts to compete with one another. We show that the majority of voters will elect the candidate who commits to a vote-share threshold that is closer to the socially optimal threshold. As a result, both candidates will commit to the socially optimal vote-share threshold.

Approach 2. In a complementary paper, we address the same issue but proceed under the assumption that candidates do know about their own ability at the beginning of the term in office, this time.¹¹ If this is the case, it is easier for them to achieve a given vote-threshold, as they know what they can achieve, albeit with more complex consequences. Less able candidates may attempt to mimic more able ones by exerting more effort.

Results. However, the efforts needed for low-ability office-holders to mimic high-ability ones may be too low. Imposing higher vote-thresholds for incumbents will essentially eliminate the worst possible equilibria, in which all candidates pool and become indistinguishable. On balance, this will improve the average ability of reelected incumbents and tend to improve the efforts exerted by office-holders. This is socially desirable.

As an illustration, consider the polar case where all policy-makers pool and produce

⁹See Gersbach (2012).

¹⁰See Gersbach (2010) and Gersbach (2017c).

¹¹See Gersbach (2017c).

the same output in terms of public projects by choosing the corresponding effort levels. Low-ability policy-makers will exert more effort than their high-ability counterparts on producing the same output, but the average level of effort will tend to be low compared to equilibria in which low-ability and high-ability policy-makers choose different output levels and only the latter group is reelected. In such an equilibrium, in which all policy-makers choose their efforts to produce the same output, they merely obtain 50% of the votes and are reelected. From the perspective of the voters, the expected abilities of the incumbent and of a challenger are the same. Imposing a higher vote threshold than 50% on incumbents eliminates such bad equilibria, as it is too costly for low-ability office-holders to mimic their high-ability counterparts. As a consequence, the only surviving equilibria will be those that cause deselection of low-ability office-holders and, on balance, yield higher welfare.

Higher barriers for incumbents and experience

Problem. Using vote-thresholds higher than 50% might be risky from a welfare point of view for the obvious reason that it may prevent office-holders from gaining experience or equivalently from learning-by-doing. Hence, in Gersbach and Müller (2017), we assess the re-election barriers that are optimal when incumbents gain socially valuable experience in office.

Approach. We develop a two-period model in which the output of a public good depends on an office-holder's effort, ability, and experience. Candidates learn their ability only once in office, and after choosing their level of effort. While campaigning for election to an open seat in the first period, candidates can make binding offers as to the minimum share of the votes they must obtain to be re-elected in the second period, provided they win in the first.

Results. We show that, in equilibrium, both candidates will offer the same vote-share threshold, that it will exceed 50%, and that it is socially optimal. The higher threshold will increase expected effort over both periods and will tend to raise the expected level of ability of office-holders in the second period. Together, these effects outweigh the expected loss of incumbents' acquired experience, which results from the lower chances they have of being re-elected in the face of the higher barrier. All the above conclusions also hold if the optimal threshold is set by law instead.

The key point of Gersbach and Müller (2017) is that although such experience is socially valuable in office and will attract more votes, higher barriers for incumbents will result in the deselection of the significantly less able among them. Moreover, higher barriers for incumbents tend to motivate newly elected candidates to exert more effort in producing public goods. It is found that these latter effects can outweigh the expected drawbacks resulting from losing out on incumbents' experience.

Moreover, the socially optimal vote-threshold is increasing in terms of experience value, as it raises the gain in welfare over and against standard elections. The reason is that voters then are more inclined to vote for incumbents with a given degree of ability, which they can infer from their performance in office. Accordingly, these incumbents will be supported by a larger majority in their re-election bid. Higher vote-share thresholds, moreover, induce higher effort in the first period. Finally, low political polarization yields high vote-thresholds in equilibrium, since it is easier for incumbents with high or intermediate ability levels to obtain the support of large majorities.

Curbing Polarization

Higher Re-election hurdles might also be used to curb polarization. Gersbach et al. (2021c) aim at a better understanding of the connection between re-election hurdles and political polarization. They use a two-period model in which a politician is elected for office in the first period and enacts a new policy. In the second period, elections take place between the incumbent and a challenger, and the winner chooses the extent to which the first-period policy should be changed. Changing a policy is costly, and such costs increase with the policy shift and accrue to the parties and voters. We show that raising the vote-share needed for re-election above one half reduces policy polarization and increases utilitarian welfare. Moreover, a particular (intermediate) reelection hurdle for the incumbent simultaneously minimizes policy polarization and maximizes welfare. The reason is that with higher reelection hurdles, office-holders adopt more moderate positions in order to remain attractive for moderate voters on the other side of the political spectrum. Too high reelection hurdles, however, lower reelection chances too much, and cause excessive and costly turnover, while still reducing polarization.

3.3 The protection of minorities

Problem. The protection of minorities is a classical theme in political philosophy and political science. Several ways have been developed to achieve this, such as proportional representation, which gives a say to minorities in political decision-making bodies, or laws that cannot be eliminated by a simple majority (see e.g. Guinier (1994)). So-called "basic rights" or "basic liberties", which cannot be taken away by any supermajority, are likely to be the starkest form of minority protection.

Yet, even if the above approaches may not be called for and even if decisions by majority rule satisfy desirable axioms (May (1952)) and are mostly perceived as fair, it may be important for every voter to be in the majority from time to time. Otherwise, although each past decision will have reflected the preferences of the majority, those citizens who never see their preferences represented will suffer recurrent utility losses. This may be undesirable from a utilitarian perspective and even more problematic if the ensuing in-

equalities are socially undesirable. Moreover, recurrent losers may desist from further participation in such a democracy, which may threaten social cohesion. Accordingly, it is important not to let large and persistent minorities lose too often. This problem has been the focus of a sizable literature on how the number of representatives of groups (e.g. states) in a society should be determined when the collection of representatives (say e.g. a parliament) makes repeated decisions. Since the classical statistical argument of Penrose (1946) for degressive proportionality—the number of representatives compared to the population size should decrease with population size—, this literature has advanced. For instance, Koriyama et al. (2013) show that degressive proportionality can be justified as a utilitarian social criterion.

We analyze the same problem, but for a polity in which every citizen initially participates in collective decision-making and no representatives are chosen or can be chosen.

Idea. In particular, we address the problem with the concept of "Minority Voting" (MV), a power of decision only granted to minorities once initial decisions split the polity into a majority and a minority. Here we analyze MV in three different settings and variants.

3.3.1 Minority Voting and long-term decisions

Approach 1. Minority Voting is a scheme that can partially protect individuals from the risk of repeated exploitation.¹² We consider a committee of citizens meeting twice to decide whether to adopt two projects. Adopting the first-period project has a long-lasting impact and its consequences are risky. Adopting the second project adds further risky benefits or losses. Citizens are risk-averse and have concave utility functions over the cumulative benefits/losses from the sequence of projects, where the utility of the status quo is normalized to zero.

If using the simple majority rule for both projects, individuals face the risk that losses accumulate over time if they repeatedly belong to the minority. This is undesirable from an ex ante perspective.

With Minority Voting, only individuals belonging to the minority in the first period are allowed to vote in the second period. The advantages of this idea are illustrated by the following example, where a community has to decide about two technologically independent infrastructure projects. Suppose a municipality has to make a two-fold decision, first, on whether to build a new expressway, and second, on whether to build an airport, thus increasing air traffic and noise.

With Minority Voting, the expressway decision also takes place via the simple-majority rule, but only the minority from the first stage of the voting will vote on whether to build the airport. Such a procedure gives individuals living close to the new road and thus suf-

¹²See Fahrenberger and Gersbach (2010).

fering from increasing noise a better chance of protecting themselves from further noise pollution caused by air traffic. Vice versa, individuals in favor of better and faster traffic routes may have a better chance of realizing at least one of the infrastructure projects, as a defeat in the first stage will exclude their opponents from involvement in the decision on the airport. These are the basic trade-offs implicit in Minority Voting.

In comparison with voting twice on the basis of simple majority rule, Minority Voting, on the one hand, protects individuals from being repeatedly outvoted. On the other, some individuals are excluded from decision-making in the second period, which creates negative externalities. Our goal is to identify the circumstances under which Minority Voting is preferable to repeated simple-majority voting for technologically independent projects with long-term impacts.

Results. Fahrenberger and Gersbach (2010) characterize the equilibria under Minority Voting (in Gersbach 2009a). Typically, such equilibria involve the formation of the smallest majority and thus the largest minority in the first period, as every individual in the majority must be pivotal. Our central finding is that Minority Voting is superior to repeated simple-majority voting according to the ex-ante utilitarian criterion as soon as the degree of risk aversion exceeds some threshold value. In such circumstances, increasing the future voting power of minorities goes hand in hand with an increase in aggregate efficiency.

3.3.2 Minority Voting and public project provision

Approach 2. In the second variant, we extend our setting to include public project provision and use the same two-round process to allocate public projects in a polity.¹³ The connection between taxes and voting outcomes enables us to protect minorities and provide public projects efficiently. The procedure works as follows:

In the first round, a society decides via simple-majority voting whether to provide itself with a public project. If the project is rejected, the process ends. If a majority favors the public project, the process continues, but only the members of the minority retain the agenda and voting rights for the second round, which determines how the project is to be financed. In the second round, either the unanimity rule or the simple-majority rule is applied.

In comparing Minority Voting to simple majority voting with regard to public project provision, we focus on the two second-round options, applying either the unanimity rule under Minority Voting or the simple-majority rule as in the first round.

Results. In Gersbach (2009a), the following properties are characteristic of equilibria under Minority Voting: When the public project is proposed in the first round, only those individuals who value the project highly—i.e. highly enough to live with the maximum

¹³See Gersbach (2009a).

tax payment that may occur in the second round—will support the proposal. If the project is supported in the first round, the supporting majority will be minimal. Every supporting individual must be pivotal, since supporting individuals will forfeit their right to vote in the second round. If the project is rejected in the first round, the collective choice process ends. If the project is adopted, an equilibrium financing scheme sets in, with subsidies for project losers designed to gain the support of all losing voters from the first round. All winning voters from the first round pay the highest admissible tax rate to finance both the project and the subsidies. The agenda-setter will also tax all other project beneficiaries in order to generate subsidies for themselves.

The attractive feature of the Minority Voting scheme is that individuals who benefit largely from a project pay more taxes, while individuals who benefit little or are disadvantaged by the project are protected from high tax payments, at least partially. Moreover, by using the unanimity rule in the second round, Minority Voting ensures that only Pareto improvements occur and that three of the standard inefficiencies in democratic decision-making are avoided: Inefficient projects are neither proposed nor adopted; inefficient redistribution schemes are neither proposed nor adopted; and when proposed, efficient projects are not rejected. The drawback of Minority Voting is that efficient projects may not be proposed in the first round. Accordingly, we also compare Minority Voting with the standard simple-majority-rule framework, both of them coupled with the same tax-protection rule, and compare the relative social welfare of the schemes. On balance, Minority Voting outperforms simple-majority voting on all counts, except in the following constellation: A socially desirable project is adopted under simple-majority rule, redistribution costs do not outweigh social gains, and there is no provision for the project under Minority Voting.

Discussion. Of course, there are further rules one might consider, such as upper limits on taxation for the supporters of the project in the first round, or that a random sample of supporters can also participate in the second round. Moreover, one might require a particular quorum for supporters in the first round. We also note that Minority Voting is in the tradition of a variety of proposals how voting should be organized to provide the most useful information about individual preferences of public activities. Tideman (1996) surveys these approaches: Revelation of preferences could be achieved by a structured bargaining process, by providing insurance against uncertainty, by allowing voters to choose the decision on which they prefer to exert influence by waiving influence on another decision, or by connecting influence on public activities with individual sacrifice.

Well-known schemes are also the budget of "influence points" to be allocated to different public activities by Hylland and Zeckhauser (1979), or valuing public activities through marginal cost pricing by the pivotal mechanisms (or "demand revealing process", and the subsequent variations of this scheme (Clarke (1971) and (1972), and Groves and

Loeb (1975)).

Minority Voting on à-la-carte public projects also rests on pivotality, but it is entirely based on yes/no messages (voting) and on the separation of the project decision from the financing decision. It is implemented by a two-stage voting procedure using the simple majority rule.

3.3.3 Preferences for harmony and Minority Voting

Approach 3. The third variant extends our purview by examining repeated collective decisions in which people care about how others are treated. Our definition of the notion "preferences for harmony" is an individual's desire that others should not suffer repeatedly from the tyranny of majorities.¹⁴

Preferences of this kind manifesting themselves in group decisions are the expression of a desire for harmony, i.e., the desire of individuals that other people should not be treated badly in the voting process. As voting necessarily implies that some individuals will lose, preferences for harmony may take the form of a committee member's desire that other individuals should not lose too often. In other words, a person will experience a utility loss if other individuals repeatedly find themselves in the minority.

The model we propose formally introduces preferences for harmony in a collective voting process in which a committee meets twice to vote on projects. Subsequently, we examine voting rules in terms of their suitability for dealing with such circumstances. In particular, we compare the relative social efficiency of the simple-majority rule with Minority Voting. The essential point of Minority Voting is to reduce the likelihood that an individual will suffer repeatedly from being in the minority. As such, it is better at satisfying preferences for harmony. The downside of Minority Voting is that some individuals will lose the right to vote, so that voting on the second project may produce an outcome that is detrimental to the material well-being of a majority of committee members.

Results. Our main result in Fahrenberger and Gersbach (2012) is that Minority Voting outperforms the simple-majority rule if preferences for harmony are sufficiently strong. Accordingly, it is worth testing the advantages of the Minority Voting procedure when there is appreciable concern among the voters to avoid recurrent losses affecting the same group, i.e. when some form of minority protection is a desideratum for a large part of the electorate.

3.3.4 Ex ante and interim anonymity

The various forms of Minority Voting satisfy ex-ante anonymity since all voters have the same rights. However, anonymity is violated after the first vote has taken place: Some

¹⁴See Fahrenberger and Gersbach (2012).

voters have more voting rights since they have been in the minority in the first stage. This is, of course, a serious concern.

Hence a word of caution is necessary. Minority Voting—and Balanced Voting, which will be introduced in the next subsection—imply that some voters will end up with more voting rights than others. Those who get to vote more times than others are determined by voting behavior and outcome in the first round. Hence, while ex-ante the voting scheme satisfies anonymity and thus treats everybody in the same way, it is possible to object to such voting schemes on principled grounds because ultimately, not all voters will have the same voting rights over the entire voting process. This is an important objection, and only future research will tell whether such voting schemes can indeed be applied in real-world contexts.

We also stress that there are several ways to mitigate this problem. One might give all citizens the same amount of votes over a larger number of issues and allow them to distribute the votes over the issues. Yet, when a citizen is in the majority on the current issue, s/he may be forbidden voting in the next issue, unless this is the final issue.

Moreover, in representative democracies, there are ways to give minorities a say in political decision-making. For instance, groups of individuals that are repeatedly in the minority may be given a district in which they have a majority and thus can ensure that a representative from among them is elected to parliament.

3.4 Balanced Voting

A simple but intriguing form of democracy for repeated collective decisions is to allow voters to distribute their voting rights across these decisions. Thus, they can allocate their votes to the issues they care most about. Such a scheme can express their intensity of preferences, at least to some extent. This idea is introduced in Mueller (1973) as an alternative to markets for votes. Mueller suggests endowing each voter with 1'000 points, to be divided over multiple binary decisions. Each decision is resolved according to the majority of total points cast on the decision.

More recently, such a scheme was proposed and analyzed by Casella (2005) under the name "Storable Votes" (SV) and, independently, by Hortala-Vallve (2012), with the concept of qualitative voting. All voters are treated equally and have the same total number of votes. The number of votes cast signals the intensity of the voters' preferences on this issue, and because the expense of such votes comes at the cost of votes on other issues, there is an intuitive sense in which the voting system induces incentive compatibility. Typically, the scheme cannot achieve full efficiency, but it yields welfare improvements over majority voting and is simple to implement.

This approach has been generalized to arbitrary problems by Jackson and Sonnenschein (2007): Across problems as diverse as voting, bargaining, or the allocation of indi-

visible objects, linking decisions can work to overcome incentive constraints and achieve full efficiency in the limit, with the number of linked decisions going to infinity. The scheme has been further developed (see Casella (2012)), including ways to protect minorities (Casella et al. (2017)).

A new scheme for striking a balance between intensity of preferences and the protection of minorities is "Balanced Voting" (BV). It is particularly suitable for fundamental societal decisions.¹⁵

Problem. Politics are repeatedly confronted with the need to take decisions of fundamental significance for a large group of citizens. Decisions such as doing away with abortion rights, reversing the course in public indebtedness through debt brakes, enacting comprehensive labor market reforms, joining or exiting the European Union have a large and long-lasting impact on the direction a society takes. When a democratic society takes such decisions, some subgroups strongly favor or oppose a fundamental new direction, while others may care much less.

Using simple majority voting to take such fundamental decisions may be particularly problematic, since it does not enable active participants to express the intensity of their preferences. The majority will invariably overrule the minority, even if this minority is much more concerned than the majority about the direction in which society is going. Enabling the minority to veto the resulting decision might mitigate the problem, but it could also be problematic. Protection of the minority might then turn into tyranny by the minority.

Idea. Balanced Voting is a two-stage set-up. Suppose a society or a committee of individuals is called upon to vote on two related binary decisions. The first decision determines the fundamental direction, a direction which to all intents and purposes is irreversible. An example is the choice between leaving the European Union (EU) and remaining in it. The second decision establishes how the choice on the fundamental direction is to be realized. For instance, upon leaving the EU, a country might agree on a customs union with the EU, settle for a free-trade agreement with the EU or may ball back on WTO rules governing trade with the EU.

Under Balanced Voting, agents have the option in the first stage of either voting on the fundamental (new) direction envisaged or abstaining. Those who abstain "save" their voting rights for the second stage. The losers in the first round receive voting rights for the second stage, while the winners in the first round are not allowed to vote in the second. Balanced Voting thus enables individuals who do not feel strongly about the fundamental decision to trade off their voting rights in the first stage for a guaranteed voting right in the second stage. Those agents who voted for one fundamental direction but lost out are compensated by the right to vote in the second round. Balanced Voting is perfectly well illustrated by a decision process of an everyday nature. Consider a group

¹⁵See Gersbach and Wickramage (2021).

of five individuals planning to spend the weekend together. They first vote on whether to go to France or Italy and then choose between a bicycle tour and a hiking trip. A voting process under Balanced Voting with five individuals, A, B, C, D, E, might look like Figure 1.

1st Round	2nd Round
Country	Type of Tour
France/Italy	Bicycle/Hiking
A, B, C choose to vote in 1st round	D, E choose to vote in 2nd round + loser of 1st round
2:1	2:1
{A, B} : {C}	{C, D} : {E}
2 winners (A and B)	2 winners (C and D)

Figure 1: Balanced Voting Example.

Balanced Voting enables A and B to have their say on the country to go to, since this is more important for them than biking or hiking. Loser C from the first round will at least come out on top in the second ballot. C is the only person who can vote twice. D and E, who care about the touring option, abstain in the first ballot. In the second round, one of them, D, wins. E is the only one who never wins.

Approach and results. We examine Balanced Voting for a particular scenario in which individuals have either high or low stakes in the first decision. The first group cares most about the first collective decision. We show that, in equilibrium, individuals with high stakes in the decision will participate in the first voting stage, while those who have low stakes abstain. Losers from the first voting round and those who abstained participate in the second round. We identify the circumstances under which Balanced Voting performs well with regard to utilitarian welfare and Pareto dominance. We demonstrate that with regard to utilitarian welfare, Balanced Voting is superior to simple majority voting, Storable Votes, and Minority Voting. Moreover, the outcome under Balanced Voting Pareto-dominates the outcome under simple majority voting and Minority Voting.

Discussion. The results are established under several conditions, e.g. large utility differences between strongly inclined and weakly inclined individuals with regard to the fundamental direction and a sufficiently large voting body. One has to see how well the scheme performs under alternative circumstances. Yet, Balanced Voting might also serve as an intuitive and easily agreed-upon scheme for multiple collective decisions in small groups. As the example suggests, individuals D and E might voluntarily abstain in the first round and individuals A and B might voluntarily abstain in the second round, as a response to the first round where they obtain their preferred alternative. In small groups, Balanced Voting may thus be an intuitive scheme to intertemporarily and voluntarily

trade voting rights.

3.5 Voting Twice and a new approach to the limitation of government debt accumulation

In this subsection, we present ideas that await thorough examination in future research. In particular, we focus on the idea of spreading important collective decisions over several voting rounds, and we apply it to constrain excessive public debt. The idea is for multi-stage decision-making to act as a kind of debt brake, one that is newly constructed for every new macroeconomic environment. The simplest case is the procedure referred to as "Voting Twice" (VT). First, a vote on a deficit ceiling takes place and second, a vote for a particular budget.¹⁶

Problem. Democracies tend to push the volume of public debt beyond socially desirable levels.¹⁷ Political conflicts and the exploitation of the fiscal commons caused by fragmented governments are examples of the driving factors behind public debt. Moreover, accumulating debt enables governments to foist their fiscal burdens onto future generations. As younger generations are underrepresented or not represented at all in collective decision-making, public debt can build up quite freely and impair the well-being of future generations.

There are many suggestions how to constrain excessive government debt accumulation. These include explicit budget-deficit and debt limits, as in the Maastricht Treaty, various debt brakes, or rainy-day funds. The two long-standing problems besetting fiscal rules like these are credibility and flexibility. If fiscal rules are tight, they cannot be credible, as in the face of a recession or a banking crisis, governments go back on the constraint and obtain large support to repeal or temporarily suspend it, and sanctions can at best be weak, as the actions can help to stabilize the economy. If fiscal rules are flexible, governments will consistently take advantage of the flexibility, and the rules will not effectively constrain government debt accumulation.¹⁸

Idea. We suggest holding two votes on a given budget, i.e. Voting Twice. In the initial vote, which takes place before making budget plans, the parliament decides on the maximum deficit to be incurred in a given calendar year. In a second vote, the parliament decides on a particular budget that must honor the outcome of the first vote. Voting Twice may be effective as a debt brake even if the simple-majority rule is applied in both rounds. For example, it may reduce the number of pork-barrel projects if the proposal-maker in the first and second round are different. But there are other voting rules for the first round that can have a stronger impact over and against one-round

¹⁶See Gersbach (2009b).

¹⁷See Yared (2019).

¹⁸See Yared (2019) for an overview.

voting on the budget.

One central idea is to make it harder to obtain parliamentary support for a high deficit level, while enabling actual budgets honoring the deficit level determined in the first vote to be passed with a simple majority. A supermajority rule, for instance 60%, could be required if the budget deficit exceeds a particular threshold. Another idea is a "Flexible Majority Rule" for which the majority required to support the proposal is 50% if there is no deficit but increases with the size of the deficit. For instance, a deficit of 1% of GDP may need 55% supporting votes, a deficit of 2% may need 60%, and so forth.

These voting rules can be combined with, or even replaced by, specific rules that affect voting rights along the lines of Minority Voting, Storable Votes, or Qualitative Voting,¹⁹ as discussed in Section 3.3. One might also envision a change of voting rights between the two voting stages. Let us look at two simple examples in a unicameral legislature.

- Every parliamentary member obtains two votes and can use them freely over the two voting stages. This enables people who are particularly concerned about debt accumulation to concentrate their voting power on the first round.
- All parliamentary members vote in the first stage, but only losing voters and a fraction of winning voters are eligible to vote in the second stage.

(Tentative) considerations. Voting Twice has not been formalized yet, and the possible consequences can only be sketched. In the context of supermajority or Flexible Majority Rules in the first round, Voting Twice could have several advantages. First, no external procedures and/or calculations by groups of experts are needed, as the timing of expansionary fiscal policy and fiscal consolidation is entirely determined by the parliament. Second, as long as there is a significant minority in favor of keeping government debt low, deficits and debt accumulation can be restricted, either because the altruism of this minority towards future generations is sufficiently high, or because it fears an excessive tax burden at a later stage or a decline in public goods provision in the future. It is conceivable that a significant number of such people actually exists. Third, if governments were allowed to use budget surpluses in one year to make up for deficits in another term, this might very well make it tempting for governments to run temporary surpluses to avoid being dependent on the support of the political opposition for a specific deficit level in the future.

Fourth, if a government has a bare majority, it will not be forced into forming a grand coalition when it intends to pass a budget in the second round once it has obtained the deficit level from the first round. Fifth, in downturns, or when natural disasters have occurred, there is scope for running a higher deficit if a sufficiently large majority supports it, which is likely in such cases.

¹⁹See Hortala-Vallve (2012).

Voting Twice is a new approach to the limitation of government debt accumulation. Numerous issues have yet to be explored, and identification of the optimal rule to be applied in the first round will require a fully-fledged research program in its own right.

4 Proposal-dependent Voting

4.1 Reflections on the majority rule

We start with the majority rule in general as a basis for our reflections. Majority rule is a cornerstone of democracy. In its relative (or absolute) form, it is used every day in political and other multi-member decision-making bodies and in elections to bodies operative in the executive and legislative branches. Every democratic society ultimately depends on it for its cultural evolution. As the core majority-decision concept gives every individual equal decision power, irrespective of their societal, financial or religious standing, it is instrumental in fostering cohesion and ensuring support for all decisions made in this way, even from those individuals who find themselves in a minority. Scientifically, the foundations on which it stands are sound.

In particular, majority rule is the only collective decision rule that satisfies three principles: anonymity, neutrality, and positive responsiveness.²⁰ The first principle, anonymity, says that voting outcomes must only depend on the number of votes cast and not on who voted and/or how the voters cast their votes. The second principle, neutrality, means that every voting alternative is treated in the same way. The third principle, positive responsiveness, means that an individual voter can have an impact on the collective decision if the difference between the votes for each alternative is one or zero.

Problems. Despite their obvious appeal, their almost universal use, and their central role in the development of civic societies, relative or absolute majority rules—and supermajority rules—have a number of drawbacks, most of which stem from the fact that these rules do not capture the intensity of preferences and cannot be tailored to specific situations governing collective choice.²¹ A majority that has little benefit from opting for a given alternative might impose its will on a minority that stands to suffer greatly from this choice. This constellation is exacerbated if a certain group of citizens repeatedly finds itself in the minority, either for a lengthy period or with regard to a series of important decisions. Over time, such a situation will be perceived as unfair and calls for some kind of tool acting as a corrective.

Conceivable tools of this kind are compensation for the minority or specific voting

²⁰See May (1952).

²¹As for any other non-dictatorial rule, the difficulties arising from Arrow's Theorem and from the Gibbard-Satterthwaite Theorem apply.

rules that protect minorities. The latter direction has been pursued in Subsections 3.3 and 3.4, with Minority Voting and Balanced Voting, respectively. Veto power, specific constitutional clauses or special laws preventing particular collective decisions could also be helpful. But while such solutions may counteract the tyranny of the majority, they cannot overcome it altogether. In fact, they may even block the majority as such, which is—as a tyranny of the minority—of course a worse state of affairs than the one they were designed to remedy.

Directly compensating minorities is another approach. To award compensation, one has to assess the extent of the loss incurred by the minority. When preferences are private information, this is a difficult—and often too difficult—task indeed. Moreover, engineering some kind of redistribution typically entails additional utility losses for those who are taxed to finance it, and these taxes distort choices on other economic activities. As a consequence, the compensation of minorities may go too far and make it impossible for a society to undertake political projects that substantially benefit a majority of individuals and fully compensate losses of the minority.

Moreover, close outcomes on major changes may not achieve legitimacy of the outcome in the polity at large. If 100 persons are called upon to vote on a decision, and if "majority" is defined as more than half of the voters, then this "collective" decision may be as close as 51 winners over and against 49 losers. If the decision has no far-reaching consequences, this may be acceptable, but if it involves major societal change or has consequences for future generations, a minority of 49 percent is substantial, and the decision is not so "collective" after all. Hence, it is crucial to examine the contents of the proposal at hand to determine the size of the minority that can still be considered acceptable. The goal is to end up with a decision that is supported by as many citizens as possible, i.e. opposed by as small a minority as possible.

One suggestion to address this problem is to vary the size of the majority required for important decisions that have major "societal weight." This societal weight can be either a profound change in citizens' lives or a change that will have long-lasting consequences and/or entail huge costs to be borne by future generations, for instance.

A typical example is the decision whether to enter or leave important intergovernmental arrangements, supranational institutions or changes in the constitution. It might, for instance be desirable to require a large majority because the decision in question might conceivably involve constitutional changes, making it important for the decision to receive as much support as possible. The guiding principle is that the greater the impact of the decision, the larger the majority needed to support it.

4.2 Flexible Majority Voting

Idea. In deciding on many problems involving small or large changes for society (depending on the scope of the proposal), another decision-making system suggests itself: Flexible Majority Rule. Flexible Majority Rules are rules for which the majority threshold depends on the proposal that has been tabled.²²

Specific examples are debt-sensitive majority rules or bail-in-sensitive majority rules. In the first case, the higher the government debt to be incurred, the greater the majority needed in parliament to approve it. In the second, the committee of a restructuring authority is required to determine the precise ratio of bail-out and bail-in for a bank in distress, and the size of the majority in the committee needed to approve a proposal depends on the percentage of bail-out to be covered by public funding.

Results. Some Flexible Majority Rules have been in use for some time now,²³ so it is worth starting the way such rules can be constructed, bearing in mind that these rules are proposal-dependent. Hence, a close examination of both the proposal and the required majority envisaged will be needed to ensure that such a voting rule is beneficial for society.

The papers on Flexible Majority Rules come up with three broad insights (Gersbach (2005), Gersbach (2009c), Gersbach and Pahl (2009), Gersbach (2011) and Gersbach (2017b)). First, Flexible Majority Rules retain the advantages of majority rule while at the same time including some form of minority protection. Second, Flexible Majority Rules can be constructed in various environments in such a way that, together with a proposal-making process, their application will maximize utilitarian welfare and outperform simple majority or any other majority rule. Third, there are limitations to the performance potential and to the use of Flexible Majority Rules. Multidimensional uncertainty about preferences is an example of the former, while decision problems only permitting a choice between two alternatives are an example of the latter.

4.3 Democratic Mechanisms, information sharing, and channeling the say

Once one realizes that Flexible Majority Rules are more efficient for votes on particular issues, it becomes clear that we need more than just a new voting rule. What we need, in fact, is a new system combining various rules to produce optimal decisions in given situations. The concept we propose for this purpose is that of "Democratic Mechanisms."

This approach is situated at the interface between mechanism design, social choice, and constitutional choice. As in mechanism design theory, we consider an environment

²²The Flexible Majority Rule was introduced in Gersbach (2005). A recent survey can be found in Gersbach (2017b).

²³See Gersbach (2017b).

with privately informed agents, and our aim is to find game forms that produce a socially desirable collective choice through the truthful revelation of private information. In two ways, our focus on Democratic Mechanisms is also related to social choice theory. First, decisions are made by voting. Second, our approach pays due heed to both the electorate's and the agenda-setter's incentives. Finally, we evaluate the Democratic Mechanism in terms of the requirement that citizens be treated equally *ex ante*, which is a central feature of constitutional choice.

4.3.1 Democratic Mechanisms

Problem. From an *ex-ante* perspective, majority rules may often produce inefficiencies in the provision of public projects. For instance, a majority may vote for a public project although the losses incurred by the losing minority outweigh the majority's benefits. Vice versa, socially desirable projects may not be adopted if beneficiaries have to compensate losers to the tune of distortionary transfers that outweigh the net benefits. Then again, an agenda-setter may not observe who benefits and who loses and may propose a financing scheme that will lead to the rejection of socially desirable projects. Finally, when those disadvantaged by public projects have the right to determine the agenda, they can prevent the provision of socially efficient public projects.

Approach. Democratic Mechanisms may avoid these types of inefficiency, as shown in Gersbach (2009c). A Democratic Mechanism is a set of rules that specify (i) costs and benefits for the proposal-maker; (ii) the restrictions that can be imposed on proposals, and (iii) the way the society in question decides on a proposal. The rules must satisfy the liberal-democracy constraint, which consists of the following sub-constraints: (a) every agent has the same chance of making a proposal; (b) every individual has the right to vote; (c) only yes/no messages and abstention are allowed at the different stages of voting; (d) every individual can abstain from proposal-making. Finally, (e) decisions have to be made on the basis of collective decision rules that satisfy anonymity. This only depends on the number of yes/no messages communicated by a set of citizens with the same characteristics. We explore the combination of rules that can achieve first-best allocations under given informational assumptions and taking under account that agenda-setters pursue their own interests.

Specifically, we consider public project provision and financing in the form of a four-stage game. In the constitutional period, the society decides unanimously about the constitutional principles governing legislative decision-making. Citizens have quasi-linear utility functions over a public project and private wealth in terms of a consumption good. Citizens are endowed with some private wealth, which will change, depending on taxes and subsidies determined in the legislature process.

At the start of the legislative period, citizens observe their own utility and decide

simultaneously whether to apply for agenda-setting or not. Among all citizens who apply, one citizen is chosen by fair randomization to set the agenda. The agenda-setter proposes a project/financing package. Taxation is distortionary, hence redistribution is costly. Once the proposal is known, citizens decide simultaneously whether to accept or not. This game is a direct translation of the four sub-constraints that constitute the liberal-democracy constraint.

Results and discussion. The combination of three rules can be expected to assure the efficient provision of public projects:

- first, flexible and double majority rules. The size of the majority depends on the proposal, and taxed and non-taxed individuals have to support the proposal;
- second, flexible agenda costs. The agenda-setter has to pay a certain amount of money if this proposal does not generate enough supporting votes;
- third, a ban on subsidies.

Two rules deserve particular attention. The first is flexible agenda costs, i.e. the agenda-setter has to pay a certain amount depending on whether the public project is proposed and adopted or whether the agenda attracts a particular share of the votes in its favor. Such costs can serve two purposes. They can motivate agenda-setters to propose socially efficient projects only. The costs can also deter individuals from applying to be agenda-setters. In this latter respect, the non-observability of other people's utility can be advantageous in achieving first-best allocations. It enables a society to set agenda costs at levels at which only project-winners will apply for agenda-setting, whereas project-losers will not. Second, we use specific double majority rules. Such rules require a majority of votes in the sets of both taxed and non-taxed individuals for a proposal to succeed. This feature leads to minority protection.

For there to be a prospect of the majority of taxed individuals supporting the proposal, the highest tax the agenda-setter can impose will be equivalent to the benefits accruing to project-winners. Taxed project-losers will always vote against a proposal to undertake the public project. Accordingly, double majority rules restrict exploitation of parts of the population. With the simple majority rule, by contrast, up to half of the population can be heavily taxed, and project adoption can still be effected.

In practice, a double majority rule is often used as follows: In order to pass a law, a majority has to be achieved in both chambers of bicameral representative democracies, e.g. the Senate and the House of Representatives in the US. In Switzerland, constitutional changes require support from a majority of all voters and a majority of cantons. The main argument for using such rules is the protection of minorities. Our double majority rule does not square with the real-world examples just cited. The justification for using double majority rules in our Democratic Mechanisms—the protection of minorities—is,

however, the same as in these constitutions. There are special circumstances where double majority rules approximating the ones in our Democratic Mechanisms are actually used in practice. In November 2002, the voters in Los Angeles were called upon to decide whether to split up the city. To make the split effective, voters were divided into two bodies (corresponding to the potential new cities) and both bodies had to support the proposal for it to go through.²⁴

4.3.2 Information sharing in Democratic Mechanisms

Problem. The ability of democratic decision-making procedures to produce and aggregate information has been the subject of a long-standing and complex debate in democracy research. Many issues remain unresolved. With the introduction of Democratic Mechanisms, the likelihood of democratic decision-making procedures achieving socially optimal solutions is heightened, thus generating new and challenging issues. One open question is whether Democratic Mechanisms can yield socially optimal solutions when the distribution of preferences among citizens is unknown and each voter only knows their own preferences. Can we construct Democratic Mechanisms that simultaneously reveal the distribution of preferences and yield the socially optimal alternative—such as the Condorcet Winner (if it exists)—for this distribution of preferences? These are the issues we address in this subsection, against the background that digitally-assisted collective decision-making opens up many new possibilities, one of them being random and representative selection of a small group of citizens in a society. To implement the Condorcet Winner, a Democratic Mechanism must overcome two obstacles, which we refer to as "manipulation" and "exploitation." First, to discover the Condorcet Winner, citizens need to share their private information by way of binary messages. One standard problem is the existence of incentives to strategically misrepresent private information, thus manipulating the mechanism. This is what we refer to as "manipulation". In addition, once the distribution of preferences has been revealed, the agenda-setter may want to use this knowledge for their own benefit rather than for bona fide implementation of the Condorcet Winner. Such strategic behavior by the agenda-setter is called "exploitation."

Idea. In Britz and Gersbach (2020a), we introduce two new features in our Democratic Mechanisms. First, we take a small random sample of the population, and its members are asked to communicate information about their preferences with a yes/no message. This random sample group may be exempted from taxation once the final decision is taken, as such an exemption may encourage sample group members to truthfully reveal their information.

Second, we employ a two-stage procedure in which the binary choice in the first stage is between the agenda-setter's proposal and an automatically-generated alternative based

²⁴See <https://www.latimes.com/archives/la-xpm-2002-jul-02-me-poll2-story.html>, accessed August 8, 2022.

on the agenda-setter's proposal.

Approach. Our work differs from the main body of literature on the well-known Condorcet Jury Theorem that focuses on information aggregation.²⁵The difference is that in our model, citizens have private information about their type. Hence, they are perfectly aware of their own preferences over the alternatives available. However, they do not know the distribution of the types of voters. Their type is a noisy signal about this distribution, which depends on some underlying state of nature. Instead of "information aggregation," we therefore use the term "information sharing" throughout. By sharing private information about their types, citizens can find out about the state of nature and thus about the distribution of types.

We consider a continuum society facing the following collective choice problem: There is a finite number of feasible public-good levels that can be arranged in order from "lowest" to "highest" level of public good provision. The individual benefits from a particular public good depend on the type of the citizen, while the costs to provide the public good are equally shared, and costs are convex with regard to the public good level. Citizens have separable utility functions over benefits and costs of public goods, and have single-peaked preferences over the space of public good levels and thus over the social alternatives.

Thus, a citizen's preferences and their peak with regard to public-good levels will depend on their privately observed type. An underlying state of nature determines the probability distribution from which each citizen's type is independently drawn. Hence, since preferences are single-peaked and each state determines a particular distribution of the citizens' peaks, each state of nature is associated with a Condorcet Winner. That is, for each state, one feasible public-good level will be preferred by the majority to any other feasible public-good level in a particular state.

In such an environment, the unknown Condorcet Winner could be found by "brute force", i.e. by letting citizens vote over each possible pair of alternatives. This would require a large number of voting rounds, and particularly so if the number of alternatives is large. Moreover, agenda-setters acting in their own interest may not propose certain alternatives, as they prefer other alternatives to be implemented. The question is whether there exist Democratic Mechanisms that find the Condorcet Winner in one or two voting rounds and in the presence of self-interested agenda-setters.

Citizens have a common prior belief about the state of nature. They can find out about the actual state, and thus the Condorcet Winner, by aggregating their private information. Yet, information aggregation is subject to two functions. Citizens may not truthfully reveal their type (manipulation) and selfish agenda-setters may exploit the

²⁵This literature has quite advanced in the past few years. See the seminal paper of Austen-Smith and Banks (1996) and Feddersen and Pesendorfer (1996, 1997, 1998). An update of the literature is given in Bouton et al. (2018).

revealed information (exploitation).

Equal voting and agenda rights, binary messages, majority voting, and selfish agenda-setters are the four features defining the notion of a Democratic Mechanism in this section, following the liberal-democracy constraint described in the previous subsection. We aim for Democratic Mechanisms involving as few voting stages as possible and hence being "procedurally efficient". We ask which Democratic Mechanisms will reliably reveal the state of nature and implement the Condorcet Winner in the collective-choice problem referred to above.

Results. We show an impossibility result and a possibility result. First, we focus on the simplest possible (baseline) Democratic Mechanisms, which rely on a single voting stage preceded by binary communication, in which a randomly-selected group of citizens is asked to vote on whether the public good level should be higher than some specific level or not. We show that a baseline Democratic Mechanism will fail to generally implement the Condorcet Winner either because citizens manipulate information sharing or because the agenda-setter exploits information sharing. Second, we construct a Democratic Mechanism that is immune to both the voters' and the agenda-setter's attempts to manipulate or exploit information sharing and that accordingly implements the Condorcet Winner.

The mechanism works as follows: A small representative sample of the population is drawn. Members of the sample group send binary messages and thereby communicate whether the public good level should be higher than some given level or not. An agenda-setter observes the sample group's messages and proposes a public-good level. This proposal is voted on in two stages. First, the entire population makes a choice between the proposal and the highest feasible alternative that is lower than the proposal.²⁶

Second, the winner of this vote is pitted against the status quo. Sample-group members and the agenda-setter are exempted from taxation if and only if the proposal made by the agenda-setter prevails in both voting stages. Tax exemption will ensure incentive compatibility of sample group members. In particular, tax exemption induces them to truthfully send binary messages in the first round, since this will ensure that the agenda-setter's proposal will be ultimately implemented. Since they are tax-exempt, they prefer the highest possible public good level that can be implemented by the agenda-setter. For this, the agenda-setter needs to obtain truthful information about the distribution of citizens' peaks. Conditional tax exemption of the agenda-setter motivates the agenda-setter to propose the Condorcet Winner. Otherwise, his/her proposal will lose against the lower public good level that will automatically be put against their proposal.

In particular, we show that this Democratic Mechanism yields truthful information sharing, optimal public-good provision, and consequently the implementation of the Con-

²⁶While the rule depends on the fact that the set of social alternatives is discrete, it can be extended to other environments. If the set of alternatives is of a very fine grain or even a continuum, one can consider alternatives that are at some distance to the agenda-setter's proposal. Of course, one might not exactly reproduce the efficiency results of the basic version.

dorcet Winner in two voting stages. Due to conditional tax exemption, the Democratic Mechanism leads to distortions away from the Condorcet winning utility allocation, which, however, can be made arbitrarily small by making the size of the representative sample arbitrarily small. In other words, the Democratic Mechanism is incentive-compatible and approximately Condorcet-efficient.

4.4 Channeling the final say in politics: A simple mechanism

Problem. While more sophisticated Democratic Mechanisms can solve more complex collective choice problems, it is also of high importance to find well-performing, simple mechanisms for democracy. We explore such mechanisms in this section, in particular with respect to proposal-making (see Gersbach et al. (2021a)). Our starting question is whether it is possible to design a legislative bargaining procedure for public project provision in such a way that outcomes maximize aggregate utility when the distribution of winners and losers is common knowledge and thus the problem to find such a distribution—as discussed in the last section—is not present.

Idea and Approach. We design a simple dynamic proposal-making procedure that works as follows. The environment consists of a large legislature of legislators (or members), which decides by majority rule whether or not to carry out a costly public project. Legislators have quasi-linear utility functions over combinations of public goods and private wealth. Individual utilities are heterogeneous, with some legislators benefiting from the project (winners) and the others losing (losers) relative to per-capita costs.

We proceed on the assumption that losers account for a majority of the legislature, but our results also hold when winners account for a majority. We further consider that there are small but positive deadweight costs of redistribution. Since all citizens have the same quasi-linear utility functions, a (utilitarian) socially optimal allocation thus requires the absence of distortionary transfers. It also prescribes project provision if and only if aggregate benefits exceed production costs. Whether a project is socially efficient or not, as well as the identity of winners and losers and their share in the legislature, is common knowledge, but the exact valuations of the project are privately known to each of the legislators.

If all legislators are losers (or all are winners), the question whether to carry out the project or not is trivial. Otherwise, voting with the majority rule can lead to inefficiencies, as the majority will impose its will on the entire legislature, no matter whether total benefits associated with the project are positive or negative. Since transfers are distortionary, a socially optimal solution cannot be achieved by simply using transfers and voting in one round, say between a proposal and the status quo (i.e., no project and no transfers).

In our setup, a proposal consists of a decision about project implementation and a

budget-neutral transfer scheme, which has to satisfy the condition that the agenda-setters have to obtain the lowest (negative) transfer among all legislators. Imposing the latter condition helps, although it is not sufficient, to motivate the agenda-setters to waive the use of socially inefficient transfers in their proposal. The set of all possible proposals (i.e., the set of alternatives) is thus very large, and the procedures to choose one proposal are also numerous and can yield very different outcomes. Both in theory and in practice, the complexity of the choice problem is typically reduced by having some agenda-setters pick a few policies from the set of alternatives in a first stage, and, in a second stage, by letting all members of the legislature decide over the selected policies through voting, as is our approach.

Specifically, we consider a dynamic mechanism that works as follows. Two proposals have to be made sequentially (by the corresponding agenda-setters) and the final decision about which proposal to implement has to be taken according to the majority rule. The main insight is that the utilitarian optimal project and financing solution is achieved when the minority makes the first and the majority makes the second proposal, i.e. winners (the minority) make the first and the losers (the majority) make the second proposal.

Results. Specifically, our main result is that this mechanism channels the final say toward utilitarian welfare optimality if the two agenda-setters are chosen appropriately. When it is socially efficient to carry out the project, optimality is attained when the first agenda-setter is a winner and the second agenda-setter is a loser whose project valuation is not too low. This suffices to ensure that the second agenda-setter will always prefer to accept implementation of the project if by doing so, s/he can eliminate all transfers made in the first agenda-setter's proposal.

When it is not socially efficient to carry out the project, optimality is attained with the same proposal-making order—namely, the minority (of winners) goes first, followed by the majority (of losers)—provided that the second agenda-setter has a valuation of the project that is not too high. This guarantees that the second agenda-setter will always find it in their best interest to pay some transfers and build a minimal winning coalition that can defeat the first agenda-setter's proposal, thereby avoiding project implementation altogether. In anticipation, the first agenda-setter will propose to maintain the status quo.

In the case of homogeneous winners and losers, it suffices for optimality that any member of the minority makes a first proposal and any member of the majority makes a counter-proposal. Because the agenda-setters' valuations and the order in which they make their proposal are essential for optimality, the mechanism can be extended by including an agenda-setter selection stage prior to proposal-making and voting. This extended mechanism elicits information about the project, so that it can be used subsequently by the chosen agenda-setters to reach the socially optimal outcome. This relaxes the information requirements that are necessary for the desired functioning of the mechanism.

Discussion. We have introduced and examined the simple mechanism in a simple model and have worked, in particular, with identical quasi-linear utility functions of all legislators. A challenging task for future research is how the mechanism performs in general environments in which utilitarian solutions prescribe transfers, even if they are distortionary or when inequality concerns are relevant.

4.5 Outlook

With these ideas, we have established a basis for future research: the concept of Democratic Mechanisms provides a theoretical framework on which we can build, both with theoretical extensions and with applications to real-life collective decision-making.

5 New Linkages through Co-voting

5.1 Co-voting for representative democracies

Once the above theoretical foundations have been established, we can return to our central objective: experimenting with digitization to improve democracy. This is our fourth and most advanced research field.

In our first field of experimentation, we extend the Assessment Voting procedure applied to direct democracy in Subsection 2.1 to the more complex setting of representative democracy. To this end, the procedure has to be significantly changed. The focus now is not so much on sequential two-round voting as on the question of how citizens can decide together with the parliament representing them. But the digital tool used for this purpose is identical: an algorithm producing a random, representative selection of citizens.

Problem. In this third decade of the 21st century, the political situation is unsettling in many countries. Specific threats such as excessive public debt, climate risks, pandemics or the spillovers of war are part of everyday life in countries that up to now have been considered safe. Many of these risks are national, but may often be global in their impact.

With such bundles of challenges, it may be particularly important to obtain voter endorsement more frequently than on election days, as such endorsement will make it easier to implement policies. It also seems that in some countries, political parties are weaker and cannot rely on a stable base of citizens anymore. Without strong and stable political parties, representative democracy appears to be less appealing.

Reforms for representative democracies may be beneficial at any time, since some of the disadvantages—such as inadequate representation of citizens—are inherent to representative democracies. Yet, reforms of representative democracy may be particularly desirable when political parties are weakened or when countries face a number of serious

threats.

Idea. Accordingly, as soon as an important decision is at hand, it might be a good idea to combine the two democratic systems—direct and representative democracy—in a judicious way, preserving their advantages and doing away with their disadvantages. To achieve this, we suggest experimenting with a new approach that we call "Co-voting". It is a new decision-making procedure that achieves co-decision by voters and government by drawing upon a representative sample of the voters, i.e. so-called "vote-holders".

Approach. We suggest that for important decisions the parliament in a representative democracy hand back part of its decision power to the voters.²⁷ Desirable and trust-enhancing as it might be to let all voters co-decide with the government as soon as an important decision is at hand, such a procedure can be complicated and very costly. Instead of turning a representative democracy into a direct democracy for specific decisions, we suggest making a subset of all voters privy to the decision. This subset would have to be representative in the eyes of all voters and legitimately speak for the electorate, so that although the greater part of the voters cannot cast a vote, they still feel that they have some measure of say in the final decision. An algorithm choosing a subset of voters randomly—e.g. a subset of 100,000, 1,000,000, or more voters, depending on the size of the country—would seem to be the obvious choice in selecting these vote-holders, in a process called "sortition" which is discussed in detail in Subsection 2.2.3. In particularly crucial cases, one might even grant the voting right to the entire electorate.

In the run-up to an important decision, a subset of this kind is selected, and its members are granted the right to vote once on this specific issue. In a separate voting procedure, the parliament has its say on the same issue. According to a pre-defined weighting key—such as 50/50, for instance—, the results of the vote-holders' decision are added to the outcome of the parliamentary decision, and the final, aggregated verdict is published and implemented. A Co-voting process of this kind can give the people a voice without dispossessing parliament of its power of decision.

Various aspects of the procedure deserve further scrutiny. Vote-holders are to be chosen randomly. Persons selected as vote-holders are informed of their right to vote in the coming decision. To ensure informed decision-making, each vote-holder is given access to the same background information as all the members of parliament.

As for the Co-voting process itself, there are two conceivable ways of going about it, each with its own advantages and drawbacks: parallel voting rounds versus "vote-holders vote first." Moreover, to avoid discretionary Co-voting appeals from the government, a rule-based approach will be best, stipulating, for example, that all changes at a constitutional level will automatically entail Co-voting. With such a rule-based approach, Co-voting ensures that citizens will be involved in important governmental decisions on a regular basis and without the consent of the government. This gives it major advantages

²⁷See Gersbach (2017a).

over referenda occasionally called by governments.

Initial results and conjectures. Analytic scrutiny of the Co-voting approach has only just begun, so that the following considerations are up to a full scrutiny by future research.²⁸ Initial results suggest that Co-voting can preserve specific advantages of direct democracy, i.e. marked inclusion of citizens' preferences in governmental decisions and a comparatively high level of expertise in decision-making. Accordingly, Co-voting may produce better results than either of the polar forms of democracy.

Co-voting might also produce other desirable outcomes or side effects. First of all, co-deciding means co-responsibility, and co-decidors will necessarily bear the consequences of the decision, backing the government even if those consequences are negative. This means that the government cannot be held solely responsible, especially if difficulties are encountered in implementing the decision. Implementing policies to slow down climate change by means of a significant CO2 tax, allowing a large-scale influx of refugees, or bailing out other countries, for instance, are all very likely to generate costs, risks, and possibly discomfort in our everyday lives. Voters may find it easier to endure difficult or negative aftermaths of Co-voting decisions and may hold less of a grudge against the government if they have contributed to the decision. Second, this procedure will generally prevent hasty decisions. Third, Co-voting would reduce the risk of certain interest groups lobbying successfully for decisions in parliament that favor them at the expense of other citizens. Fourth, Co-voting may also revive the voters' interest in political decisions and encourage them in their desire to inform themselves as comprehensively as possible before making a decision.

Procedural considerations and fairness. Co-voting is a form of participatory decision-making and can be implemented for any voting method, be it at the voting booth, by letter, or electronically. The simplest way to proceed is to have all vote-holders vote electronically. This can also solve another problem, i.e. how to prevent vote-holders from being influenced if their identity is revealed. Chosen at random by an algorithm, vote-holders are best informed of their right to vote by electronic messaging; they should retrieve the background information they need for their decision electronically, and they should cast their vote electronically as well. Encryption can be done in the same way as for e-banking transactions, so that no one can find out against the vote-holders' will who the vote-holders are, nor can anyone interfere with the voting. Of course, as current research on electronic voting suggests, it is no trivial task to construct a voting system that provides for anonymity, secure and verifiable voting at the same time as effectively preventing vote-selling.

If vote-holders are to be perceived as representing the people, then every voter must be given the same chance of becoming a vote-holder. This requires the possibility of contacting every voter electronically or the obligation for voters who wish to act as vote-

²⁸See Gersbach et al. (2022b).

holders to register electronically and to agree to the use of an encrypted account to retrieve information and to vote. One might also envision the possibility for vote-holders to waive their right to vote on a certain decision if they do not want to participate in Co-voting. Then, the algorithm can simply select another citizen as a stand-in vote-holder.

Remarks. While Co-voting is a new form of collective decision-making, there are parallels—either by double-majority rules or by institutions fostering the participation of citizens. First, it is common to have double-majority rules for particular, single decisions in representative democracies with two parliamentary chambers. For instance, particular decisions may need the approval of both High and Low Chambers. Second, bringing the views of the citizens to the attention of parliament is the idea of the three chambers France, the Senate, the Assemblée Nationale and the "Conseil Economique, Social et Environnemental". This third chamber, the CESE, among other duties, is entrusted with citizen's participation. It organizes citizens' conventions and other forms of citizen participation, often using random selection. There also exists a similar structure at European level.²⁹ Moreover, participatory budgeting also involves citizens into the process of deciding how public money is spent. Yet, we envision a real Co-voting on laws between the parliament and citizens.

5.2 Other forms of Co-voting

We have focused on Co-voting by citizens and parliaments. One might also envisage other forms of Co-voting that are perhaps somewhat utopian. For instance, one might imagine Co-voting being used by Tech Giants (such as Facebook, Twitter, and Metaverse, for instance) operating important social media to define censorship rules. It may also be extended to other Tech Giants dominating the evaluation and search tools that are essential for the daily life of citizens. In such cases, Co-voting might involve elected representatives of users of services of Tech Giants and Tech-Giant managers.³⁰

One might also envisage Co-voting being used for important long-term decisions binding on different successive governments or for decisions taken by current generations with an impact on future generations, with future generations being simulated by artificial intelligence.

6 Conclusion and Outlook

We hope that this account of ideas for new forms of democracy demonstrates how many more possibilities we have to organize and govern democratic societies—there is no end to such ideas.

²⁹See <https://www.eesc.europa.eu/>, accessed August 8, 2022.

³⁰For more details, see Gersbach (2020b).

Besides further variants of the voting and election rules we presented, one might also consider new ideas for the organization of democracy itself. One could think of improvements of the current divide between legislative, executive and judicial power, and the associated separation of power, starting from ideas like "Catenarian Discipline", for instance or optimal term length.³¹

The presented account should also show how the democratic tools we have developed over the last two decades can be made more efficient and less costly by taking full advantage of the great leap forward in digitization that we have observed in recent times. Many of the new forms of democracy and the support through digital tools have not been explored yet, and while, of course, we have to remain extremely circumspect in our attempts to employ them, we contend that they have the potential to protect, promote, and extend the scope of collective decision-making and ultimately, to ensure the viability of democracy.

³¹For more details, see Gersbach (2014), Gersbach et al. (2020a) and (2020b).

7 References

B. Abramowitz and N. Mattei. Flexible representative democracy: An introduction with binary issues. Proceedings of the 28th International Joint Conference on Artificial Intelligence, AAAI Press, pp. 3–10, 2019.

J.R. Alford and D.W. Brady. Personal and partisan advantage in US congressional elections. In Dodd, L. C. and Oppenheimer, B. I., editors, *Congress Reconsidered*. Praeger, New York, NY, 1989.

D. Alger. Voting by proxy. *Public Choice*, 126(1–2):1–26, 2006.

D. Austen-Smith and J. Banks. Information aggregation, rationality, and the Condorcet Jury Theorem. *American Political Science Review*, 90:34–45, 1996.

D. Austen-Smith and T. Feddersen. Deliberation, preference uncertainty and voting rules. *American Political Science Review*, 100(2):209–217, 2006.

L. Bartholdi, W. Hann-Carruthers, M. Josyula, O. Tamuz, and L. Yariv. Equitable voting rules. *Econometrica*, 89(2):563–589, 2021.

M. Battaglini, R. Morton, and T. Palfrey. Information aggregation and strategic abstention in large laboratory elections. *American Economic Review: Papers and Proceedings*, 98(2):194–200, 2008.

M. Battaglini, R. Morton, and T. Palfrey. The swing voter’s curse in the laboratory. *Review of Economic Studies*, 77:61–89, 2010.

S. Bhattacharya. Preference monotonicity and information aggregation in elections. *Econometrica*, 81(3):1229–1247, 2013.

L. Blondiaux and B. Manin (eds.). *Le Tournant Délibératif*, Paris, Presses de Sciences Po, 2021.

C. Blum and C.I. Zuber. Liquid democracy: Potentials, problems, and perspectives. *Journal of Political Philosophy*, 24(2):162–182, 2016.

P. Bond and H. Eraslan. Strategic voting over strategic proposals. *Review of Economic Studies*, 77(2):459–490, 2009.

D. Bourg, M.-A. Cohendet, L. Blondiaux, J.-M. Fourniau, F. Augagneur and B. François. *Inventer la Démocratie du XXie siècle: L’Assemblée Citoyenne du Futur*, Paris, Les liens qui libèrent, 2017.

L. Bouton, A. Llorente-Saguer, and F. Malherbe. Get rid of the unanimity rule: The superiority of majority rules with veto power. *Journal of Political Economy*, 126:107–149, 2018.

H. Brighthouse and M. Fleurbaey. Democracy and proportionality. *Journal of Political Philosophy*, 18(2):137–155, 2010.

M. Brill and N. Talmon. Pairwise liquid democracy, IJCAI, pp. 137–143, 2018.

V. Britz and H. Gersbach. Information sharing in Democratic Mechanisms. *International Journal of Game Theory*, 49:547–577, 2020.

- V. Britz and H. Gersbach. Pendular voting. CER-ETH Working Paper, 21/350, 2021.
- J. Buchanan and G. Tullock. *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. University of Michigan Press, Ann Arbor, MI, 1962.
- J.L. Carson, J. Sievert and R.D. Williamson. Nationalization and the incumbency advantage. *Political Research Quarterly* 73(1):156–168, 2020.
- A. Casella. Storable votes. *Games and Economic Behavior*, 51:391–419, 2005.
- A. Casella. *Storable Votes: Protecting the minority voice*. Oxford University Press, Oxford, 2012.
- A. Casella, JF. Laslier, and A. Macé. Democracy for polarized committees: The tale of Blotto’s lieutenants. *Games and Economic Behavior*, 106:239–259, 2017.
- A. Casella and A. Macé. Does vote trading improve welfare? *Annual Review of Economics*, 13:57–86, 2021.
- J.R. Chamberlin and P.N. Courant. Representative deliberations and representative decisions: Proportional representation and the Borda Rule. *American Political Science Review*, 77(3):718–733, 1983
- B. Chandar and EG Weyl. Quadratic voting in finite populations. Stanford Graduate School of Business Working Paper, 2019.
- Z. Christoff and D. Grossi. Binary voting with delegable proxy: An analysis of liquid democracy. *Proceedings of the Sixteenth Conference on Theoretical Aspects of Rationality and Knowledge, TARK 2017, Liverpool, UK, 24–26 July 2017*, pp. 134–150, 2017.
- Z. Christoff and D. Grossi. Liquid democracy: An analysis in binary aggregation and diffusion, 2017, <https://arxiv.org/abs/1612.08048>.
- M. Chwe. Minority rights can maximize majority welfare. *American Political Science Review*, 93(1):85–97, 1999.
- E. Clarke. Multipart pricing of public goods. *Public Choice* 11:17–33, 1971.
- G. Cohensius, S. Mannor, R. Meir, E. Meirom and A. Orda. Proxy voting for better outcomes. *Proceedings of the 16th Conference on Autonomous Agents and Multi-Agent Systems, International Foundation for Autonomous Agents and Multiagent Systems*, pp. 858–866, 2017.
- JS. Coleman. The possibility of a social welfare function. *American Economic Review*, 56:1105–1122, 1966.
- P. Coughlan. In defense of unanimous jury verdicts: Mistrials, communication and strategic voting. *American Political Science Review*, 94:375–393, 2000.
- G.W. Cox and J.N. Katz. Why did the incumbency advantage in US House elections grow? *American Journal of Political Science*, 40(2):478–497, 1996.
- M. Dold and P. Lewis. F.A. Hayek on the political economy of endogenous preferences: An historical overview and contemporary assessment. *Journal of Economic Behavior and Organization*, 196:104–119, 2022.
- J.X. Eguia, H. Immorlica, K. Ligett, G. Weyl, and D. Xefteris. Quadratic voting with

multiple alternatives. Michigan State University, Department of Economics Working Paper, 2019-01, 2019.

JX. Eguia and D. Xefteris. Implementation by vote-buying mechanisms. *American Economic Review*, 111(9):2811–2828, 2021.

R. Eichenberger and P. Schafer. On curing political diseases: The healing power of majoritarian elections in multi-member districts. *Homo Oeconomicus*, 2022 forthcoming. <https://doi.org/10.1007/s41412-022-00131-w> (accessed October 4, 2022).

J. Elster. *Deliberative Democracy*, Cambridge University Press, Cambridge, 1988.

T. Fahrenberger and H. Gersbach. Minority Voting and long-term decisions. *Games and Economic Behavior*, 69(2):329–345, 2010.

T. Fahrenberger and H. Gersbach. Preferences for harmony and Minority Voting. *Mathematical Social Sciences*, 63(1):1–13, 2012.

T. Feddersen and W. Pesendorfer. The swing voter’s curse. *American Economic Review*, 86:408–424, 1996.

T. Feddersen and W. Pesendorfer. Voting behavior and information aggregation in elections with private information. *Econometrica*, 65:1029–1058, 1997.

T. Feddersen and W. Pesendorfer. Convicting the innocent: The inferiority of unanimous jury verdicts. *American Political Science Review*, 92:23–35, 1998.

D. Felsenthal and H. Nurmi. *Voting Procedures for Electing a Single Candidate: Proving Their (In)Vulnerability to Various Voting Paradoxes*. Springer, 2018.

B. Flanigan, P. Gözl, A. Gupta, B. Hennig and A.D. Procaccia. Fair algorithms for selecting citizens’ assemblies. *Nature*, 596, 26 August 2021.

B. Frey. Proposals for a democracy of the future. *Homo Oeconomicus*, 34:1–9, 2017.

W. Gehrlein and D. Lepelley. *Elections, Voting Rules and Paradoxical Outcomes*. Springer, 2017.

A. Gelman and G. King. Estimating incumbency advantage without bias. *American Journal of Political Science*, 34(4):1142–1164, 1990.

D. Gerardi and L. Yariv. Deliberative voting. *Journal of Economic Theory*, 114:357–394, 2007.

H. Gersbach. Information efficiency and majority decisions, *Social Choice and Welfare*, 12:363–370, 1995.

H. Gersbach. Public information and social choice, *Social Choice and Welfare*, 17:25–31, 2000.

H. Gersbach. *Designing Democracy: Ideas for Better Rules*. Springer, 2005.

H. Gersbach. Minority Voting and public project provision. *Economics–The Open-Access, Open-Assessment E-Journal*, 2(2009-35), 2009a.

H. Gersbach. Voting Twice: A new approach to the limitation of government debt accumulation. www.voxeu.org, (17 June 2009), 2009b.

- H. Gersbach. Democratic Mechanisms. *Journal of the European Economic Association*, 7(6):1436–1469, 2009c.
- H. Gersbach. On higher hurdles for incumbents. *Economics Bulletin*, 30(1):774–785, 2010.
- H. Gersbach. On the limits of democracy. *Social Choice and Welfare*, 37(2):201–217, 2011.
- H. Gersbach. Contractual democracy. *Review of Law and Economics*, 8(3):823–851, 2012.
- H. Gersbach. Catenarian Fiscal Discipline, Voxeu Column, January 4, 2014, <https://cepr.org/voxeu/columns/catenarian-fiscal-discipline>, accessed
- H. Gersbach. Assessment Voting: Ein Vorschlag aus dem Labor der ETH Zürich zum Umgang mit Volksinitiativen. *Neue Zürcher Zeitung*, (28.4.2015), 2015.
- H. Gersbach. Co-voting democracy. *Economics of Governance*, 18:337–349, 2017a.
- H. Gersbach. Flexible majority rules in Democracyville: A guided tour. *Mathematical Social Sciences*, 85:37–43, 2017b.
- H. Gersbach. *Redesigning Democracy: More Ideas for Better Rules*. Springer, 2017c.
- H. Gersbach. History-bound reelections. *American Economic Journal: Microeconomics*, 12(3):33–75, 2020a.
- H. Gersbach. Democratizing Tech Giants! A Roadmap, *Economics of Governance*, 21, 351–361, 2020b.
- H. Gersbach, S. Imhof and O. Tejada. Channeling the final say in politics: A simple mechanism, *Economic Theory*, 71, 151–183, 2021a.
- H. Gersbach, M. Jackson and O. Tejada. The optimal length of political terms, CEPR Discussion Paper No. DP14857, 2020a.
- H. Gersbach, M. Jackson, P. Muller and O. Tejada. Electoral competition with costly policy changes: A dynamic perspective, CEPR Discussion Paper No. DP14858, 2020b.
- H. Gersbach and T. Kleinschmidt. Power to youth: Designing democracy for long-term well-being, *Mathematical Social Sciences*, 58:158–172, 2009.
- H. Gersbach, A. Mamageishvili and M. Schneider. Risky vote delegation, CEPR Discussion Paper DP17044, 2022a.
- H. Gersbach, A. Mamageishvili and O. Tejada. Republic or democracy? Co-voting! CEPR Discussion Paper DP17614, 2022b.
- H. Gersbach, A. Mamageishvili, and O. Tejada. The effect of handicaps on turnout for large electorates with an application to Assessment Voting. *Journal of Economic Theory*, 195, 2021b.
- H. Gersbach and M. Müller. Higher bars for incumbents and experience. *Journal of Theoretical Politics*, 29(3):492–513, 2017.
- H. Gersbach, P. Muller, and O. Tejada. Using Re-election Thresholds to Curb Political Polarization. CEPR Discussion Paper DP16037, 2021c.

- H. Gersbach and B. Pacht. Flexible majority rules for central banks. *Journal of Money, Credit and Banking*, 41(2):507–516, 2009.
- H. Gersbach and K. Wickramage. Balanced Voting. *Mathematical Social Sciences*, 113, 203–229, 2021.
- J. Goeree and L. Yariv. An experimental study of collective deliberation. *Econometrica*, 79(3):893–921, 2011.
- J. Goeree and J. Zhang. One man, one bid. *Games and Economic Behavior*, 101:151–171, 2017.
- R. Goodin. *Innovating democracy: Democratic theory and practice after the deliberative turn*. Oxford University Press, 2008.
- J. Green-Armytage. Direct voting and proxy voting. *Constitutional Political Economics*, 26(2):190–220, 2015.
- T. Groves and M. Loeb. Incentives and public inputs. *Journal of Public Economics*, 4:211–226, 1975.
- S. Guarnaschelli, R. McKelvey and T. Palfrey. An experimental study of jury decision rules. *American Political Science Review*, 94(2):407–423, 2000.
- L. Guinier. *The Tyranny of the Majority*, Free Press, New York, 1994.
- F. A. Hayek. *The Constitution of Liberty*. University of Chicago Press, Chicago, IL, 1960 (*The Constitution of Liberty: The Definitive Edition*. In: Bruce Caldwell (ed.), *The Collected Works of F.A. Hayek*, volume XVII, University of Chicago Press, Chicago, IL, 2011).
- R. Hortala-Vallve. Qualitative voting. *Journal of Theoretical Politics*, 24(4):526–554, 2012.
- A. Hylland and R. Zeckhauser. The efficient allocation of individuals to positions. *Journal of Political Economy*, 87(2):293–314, 1979.
- M. Jackson and H. Sonnenschein. Overcoming incentive constraints by linking decisions. *Econometrica*, 75:241–257, 2007.
- A. Kahng, S. Mackenzie, and A.D. Procaccia. Liquid democracy: An algorithmic perspective. In: *Proceedings of the 32nd AAAI Conference on Artificial Intelligence*. pp. 1095–1102, 2018.
- L. Kaplow and SD. Kominers. Who will vote quadratically? Voter turnout and votes cast under quadratic voting. *American Political Science Review*, 69:125–149, 2017.
- S. Kolev. Fortifying the fragile order of democracy: Book review. *Constitutional Political Economy*, 31:142–144, 2020.
- Y. Koriyama, J.-F. Laslier, A. Macé and R. Treibich. Optimal apportionment. *Journal of Political Economy*, 121(3):584–608, 2013.
- SP. Lalley and EG. Weyl. Nash equilibria for quadratic voting. [arXiv:1409.0264v6](https://arxiv.org/abs/1409.0264v6), 2019.
- J.-F. Laslier. *Une idée en l’air sur la représentation politique*, 2017,

<https://blogs.mediapart.fr/jean-francois-laslier/blog/190417/une-idee-en-lair-sur-la-representation-politique>.

J.-F. Laslier and R. Sanver. Handbook of Approval Voting. Springer, Berlin, 2010.

B. Laurence and I. Sher. Ethical considerations on quadratic voting. *Public Choice*, 172:195–222, 2017.

S.D. Levitt and C.D. Wolfram, C. D. (1997). Decomposing the sources of incumbency advantage in the US House. *Legislative Studies Quarterly*, 22(1):45–60, 1997.

M. Mandler. The fragility of information aggregation in large elections. *Games and Economic Behavior*, 74(1):257–268, 2012.

C. Martinelli. Would rational voters acquire costly information? *Journal of Economic Theory*, 129:225–251, 2006.

E. Maug and B. Yilmaz. Two-class voting: A mechanism for conflict resolution. *American Economic Review* 92(5):1448–1471, 2002.

K. O. May. A set of independent necessary and sufficient conditions for simple majority decisions. *Econometrica*, 20(4):680–684, 1952.

J. McMurray. Aggregating information by voting: The wisdom of the experts versus the wisdom of the masses. *Review of Economic Studies*, 80(1):277–312, 2013.

J.C. Miller. A program for direct and proxy voting in the legislative process *Public Choice*, 7(1):107–113, 1969.

DC. Mueller. Constitutional democracy and social welfare. *Quarterly Journal of Economics*, 87:60–80, 1973.

K. Nehring and C. Puppe. Resource allocation by frugal majority rule. *KIT Working Papers*, 131, 2019.

J. Patty and E.M. Penn. *Social Choice and Legitimacy: The Possibilities of Impossibility*. Cambridge University Press, Cambridge, MA, 2014.

A. Paulin. Through liquid democracy to sustainable non-bureaucratic government. In: *Proceedings of the International Conference for E-Democracy and Open Government*. pp. 205–217, 2014.

L. Penrose. The elementary statistics of majority voting. *Journal of the Royal Statistical Society*, 109:53–57, 1946.

H.F. Pitkin. *The Concept of Representation*. University of California Press, Berkeley, CA, 1967.

M. Pivato and A. Soh. Weighted representative democracy. *Journal of Mathematical Economics*, 88(C):52–63, 2020.

S. Sterne. *On representative government and personal representation*. J. B. Lippincott, Philadelphia, 1871.

T.N. Tideman. Voting and the revelation of preferences for public activities. In D.C. Mueller editor, *Perspectives on Public Choice: A Handbook*, Chapter 11, pages 226–244, Cambridge University Press, Cambridge, 1996.

G. Tullock. *Toward a Mathematics of Politics*, University of Michigan Press, Ann Arbor, 1967.

G. Tullock. Computerizing politics. *Mathematical and Computer Modelling*, 16(8-9):59–65, 1992.

N. Urbinati. *Representative Democracy: Principles and Genealogy*. University of Chicago Press, Chicago, IL, 2006.

R. Van Weelden. Deliberation rules and voting. *Quarterly Journal of Political Science*, 3:83–88, 2008.

V. Vanberg. Liberalismus und Demokratie: Zu einer vernachlässigten Seite der liberalen Denktradition. *Hamburgisches Weltwirtschaftsinstitut Hamburg Policy Paper*, 85, 2014.

EG. Weyl. The robustness of quadratic voting. *Public Choice*, 172:75–107, 2017.

P. Yared. Rising government debt: Causes and solutions for a decades-old trend. *Journal of Economic Perspectives*, 33(2):115–140, 2019.

Abbreviations

- AG Assessment Group
- AV Assessment Voting
- BV Balanced Voting
- MV Minority Voting
- PV Pendular Voting
- SV Storable Votes